

DIVISION 300 BASES

SECTION 301 SELECT BORROW BASE COURSE

- 301 Select Borrow Base Course
- 302 Graded Aggregate Base Course
- 304 Asphalt Stabilized Base Course
- 305 Graded Aggregate for Temporary Roadway Material (TRM)

301.01 Description. This work consists of furnishing, placing, and compacting select borrow material on a prepared subgrade.

301.02 Materials. The material used for the select borrow base course shall conform to the requirements of Subsection 209.04, Borrow Type G.

Source of material for the select borrow base course shall conform to the requirements of Subsection 209.05.

Source testing shall conform to the requirements of Subsection 209.06.

CONSTRUCTION METHODS.

301.03 Equipment. The Contractor shall provide equipment of the proper type and weight to do the grading, leveling, and compacting work as specified. Compaction shall be uniformly attained by approved rollers or compactors.

301.04 Preparation of Subgrade. The subgrade shall be properly shaped. It shall also be uniformly and thoroughly compacted in conformance with the lines and grades as shown on the Plans or as established by the Engineer, before any base course material is placed. These operations shall be performed in accordance with Subsection 202.06.

The subgrade shall be maintained as established in Subsection 202.06. Test rolling shall be performed as established in Subsection 202.02.

No base course material shall be placed until the subgrade has been approved by the Engineer

301.05 Placement of Select Borrow Base Course. Select borrow base course material shall be placed in successive layers. Each layer shall be placed in a level, uniform cross-section not to exceed 8" (200 mm) in depth, loose measurement, unless otherwise approved by the Engineer. The material shall be deposited and promptly spread parallel to the centerline. Each layer shall extend the full plan width.

If a layer does not contain a uniform distribution of moisture and component materials, it shall be disc'd or processed in a manner to ensure homogeneity. Each layer shall be properly compacted, as specified, before starting the next layer.

Compaction or rolling shall start at the edges and progress toward the center and shall continue until each layer is thoroughly and uniformly compacted to the full width.

In no case shall vehicles be allowed to travel in a single track or form ruts in the base course. If any sharp irregularities are formed, the base course shall be scarified to a depth of 6" (150 mm) and recompact.

301.06 Performance Requirements. Compaction shall continue until each layer is thoroughly and uniformly compacted to 100% or more of the laboratory maximum density on representative material.

The moisture content of the select borrow base course material at the time of compaction shall be within 2% of the optimum.

The material shall either be moistened or dried, as needed, and thoroughly mixed before compaction. Field compaction shall comply with the requirements of the following AASHTO test methods as modified by the Department:

- a. AASHTO T 99 Method C, Moisture-Density Relationship.
- b. AASHTO T 191, Density By Sand Cone.
- c. AASHTO T 224, Coarse Particle Correction.
- d. AASHTO T 238, Density By Nuclear Methods.
- e. AASHTO T 239, Moisture Content by Nuclear Methods.
- f. AASHTO T 272 Method C, Moisture-Density Family of Curves.

The finished surface of the select borrow base course shall not vary from that required on the Plans by more than 2" (13 mm) when tested with a 10' (3.048 m) straightedge applied to the surface parallel to the centerline of the pavement, and when tested with a template cut to the cross-section of the pavement.

A straightedge meeting the approval of the Engineer shall be supplied by the Contractor at each placement operation. The straightedge shall be constructed of rigid materials that resist warping and bending.

301.07 Method of Measurement. The quantity of select borrow base course will be measured as the number of cubic yards (cubic meters) of Borrow Type G placed and accepted. Borrow will be measured in its original position by cross-sections and computed by the method of average end areas. The number of cubic yards (cubic meters) of borrow measured, as stated above, will not include any overburden or stripping.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used. Where the Engineer has determined it impractical to obtain a weight-volume conversion factor, 3,200 lb/yd; (1900 kg/m;) shall be used as the conversion factor. The weight will be determined according to Subsection 109.01.

301.08 Basis of Payment. The quantity of select borrow base course will be paid for at the Contract unit price per cubic yard (cubic meter). Price and payment will constitute full compensation for all clearing, grubbing, or grading required to prepare the materials source for cross-sectioning; for excavating; for furnishing, hauling, placing, discing if required, and compacting all materials; and for all equipment, tools, labor, and incidentals required to complete the work.

SECTION 302 GRADED AGGREGATE BASE COURSE

302.01 Description. This work consists of furnishing, placing, and compacting graded aggregate base course materials on a prepared subgrade or base.

302.02 Materials. The material used to construct graded aggregate base course shall conform to the requirements of Section 813 and Section 821, Type B.

CONSTRUCTION METHODS.

302.03 Subgrade Preparation. The subgrade shall be properly constructed in accordance with Subsection 202.06.

No base course material shall be placed until the subgrade has been approved by the Engineer.

302.04 Placement.

1. *Equipment.* The aggregate materials shall be spread uniformly by an approved spreading machine or box in such a manner that no segregation occurs. A conventional motor grader will not be approved for placement of graded aggregate on mainline roadway sections. Where it is not possible to use a spreading machine or box in patching or other tight areas, other approved methods can be used only in such manner that no segregation occurs. Water shall be uniformly applied with an approved sprinkling device. Compaction shall be uniformly attained by approved rollers or compactors. No graded aggregate shall be placed until approved equipment is on the Project site and is operational.
2. *Spreading and Compacting.* Graded aggregate material conforming to the requirements of Section 821 shall be placed in successive layers. Each layer shall be placed in a level, uniform cross-section not to exceed 8" (200 mm) in depth, loose measurement, unless otherwise approved by the Engineer. The material shall be deposited and spread parallel to the centerline, and the layer shall extend to the full width as shown on the Plans. The material shall be handled so that no segregation of fine or coarse particles occurs. No more than 1,000' (300 m) of material, as measured along the roadway centerline, shall be spread in advance of compaction operations.
Each layer shall be properly compacted as specified, before starting the next layer. Water shall be added before the material is compacted. The water shall be applied in a manner that results in a uniform and adequate moisture content.

Compaction or rolling shall be performed parallel to the roadway centerline starting at the edges and progressing toward the center. It shall continue until each layer is thoroughly and uniformly compacted to the full width as shown on the Plans.

After compacting, all voids in the surface of each layer shall be filled with aggregate meeting the requirements of Section 813, Delaware No. 10. Water shall be applied to the surface and compaction continued. Additional Delaware No. 10 aggregate placement, water application, and compaction shall continue until the layer of base material is well bonded and firm, as determined by the Engineer.

In no case shall vehicles be allowed to travel in a single track or to form ruts in the base course. If any sharp irregularities are formed in the subgrade or base course material, the affected area shall be scarified to a depth of 6" (150 mm) and compacted to conform to the requirements of Section 202 or this Section.

3. *Performance.* The moisture content of the base course material at the time of compaction shall be within 2% of the optimum moisture content. If the moisture content is not within 2% of optimum, the material shall either be moistened or dried, as needed, and thoroughly mixed before compaction.

Compaction of graded aggregate Type A shall continue until each layer is thoroughly and uniformly compacted into a firm and unyielding surface, to the satisfaction of the Engineer. Compaction of graded aggregate Type B shall continue until each layer is thoroughly and uniformly compacted to 98% or more of the laboratory maximum density obtained on a sample of the same material. If the material is too coarse to use the test methods listed below, compaction shall continue until there is no movement of the material under the compaction equipment.

The determination of compliance with performance requirements as specified in this Subsection shall be in accordance with the following test methods, as modified by the Department:

1. AASHTO T 99 Method C, Moisture-Density Relationship.
2. AASHTO T 191, Density By Sand Cone.
3. AASHTO T 224, Coarse Particle Correction.
4. AASHTO T 238, Density By Nuclear Methods.
5. AASHTO T 239, Moisture Content By Nuclear Methods.
6. AASHTO T 272 Method C, Moisture-Density Family Of Curves.

The finished surface of the graded aggregate base course shall not vary from that required on the Plans by more than 2" (13 mm) when tested with a 10' (3.048 m) straightedge applied to the surface parallel to the centerline of the pavement and when tested with a template cut to the cross-section of the pavement. The actual thickness of the graded aggregate base course shall not be more than 2" (13 mm) less than the thickness shown on the Plans; however, the actual thickness may be greater than that shown on the Plans. Those portions of completed graded aggregate base course not meeting these performance requirements shall be completely removed and replaced with proper material placed in accordance with this Section.

A straightedge meeting the approval of the Engineer shall be supplied by the Contractor at each placement operation. The straightedge shall be constructed of rigid materials that resist warping and bending.

302.05 Method of Measurement. The quantity of graded aggregate base course will be measured by the cubic yard (cubic meter). The volume of cubic yards (cubic meters) will be measured as the number of square yards (square meters) of surface area of graded aggregate base course, placed and accepted, multiplied by the depth shown on the Plans. If the depth of the graded aggregate base course placed and accepted is greater than the depth shown on the Plans, the plan depth will be used to measure the quantity for payment.

If the limits of measurement for pay quantities for graded aggregate base course are designated on the Plans, the quantity of graded aggregate base course measured for payment will be the number of square yards (square meters) of surface area multiplied by the depth, placed within the payment lines and grades shown on the Plans. If the limits are not designated on the Plans, or have been changed by the Engineer, in-place dimensions of the accepted graded aggregate base course will be established. The computation of quantity will be made from cross-sections taken after the completion of work under this Section.

As an alternate method of measurement, graded aggregate base course will be measured by the ton (metric ton) if so required by the Contract. The weight will be determined according to Subsection 109.01. On jobs paying by the ton (metric ton), the Engineer reserves the right to template areas for payment, through use of a conversion factor supplied by the Department, whenever the Contractor exceeds the limits of base course placement shown on the Plans.

Materials placed beyond the designated lines and grades as shown on the Plans or beyond the limits established by the Engineer will not be measured for payment.

302.06 Basis of Payment. The quantity of graded aggregate base course will be paid for at the Contract unit price per cubic yard (cubic meter) or by the number of tons (metric tons) installed, as required by the Contract for this material. Price and payment will constitute full compensation for preparing, furnishing, placing, and compacting the materials, and for furnishing all labor, equipment, tools, and incidentals required to complete the work.

No payment will be made for materials placed beyond the designated lines and grades as shown on the Plans or beyond the limits established by the Engineer.

SECTION 303 S RESERVED

SECTION 304 ASPHALT STABILIZED BASE COURSE

304.01 Description. This work consists of scarifying, stabilizing with asphalt, compacting, and shaping the base course.

304.02 Materials.

- a. Asphalt for stabilization shall be a high-float, medium-setting emulsion conforming to the requirements of Section 809. Other types of mixing grade emulsions may be submitted for laboratory evaluation and approval.

Prior to approval of any emulsion type or source of supply, the Contractor shall submit to the Department's Materials and Research Section a 1 gal (4 L) emulsion sample for laboratory analysis and mixing evaluation. A laboratory analysis report prepared by the supplier shall accompany the sample.

Laboratory evaluation shall include a determination of mixing qualities of the emulsion and water with silicious sandy soils representative of the soil types found within the Project location and conforming to Subsection 209.04, Borrow Type E. Fast breaking emulsion yielding globules of unmixed asphalt or emulsions which fail to thoroughly and homogeneously blend throughout the emulsion-water-soil mixture will be judged unsatisfactory for use. The moisture content of the soil-emulsion mixed in the laboratory shall range from 5 to 9% with optimum moisture and maximum density determined in accordance with AASHTO T 180 Method A, Modified. Molded soil-emulsion specimens will also be evaluated by air curing, water immersion, absorption, and compression testing.

All testing will be performed at the Department's Materials and Research Laboratory. Upon completion of all laboratory testing and review of the data, the decision of the Department as to emulsion acceptability will be final. Approval of the material will also be contingent on satisfactory performance under field mixing conditions.

- b. *Water.* Water to be used in the stabilizing process shall conform to the requirements of Section 803.
- c. *Soils.* All materials to be stabilized shall consist of local soils or borrow soils or a mixture of both. These materials shall be free from roots and leaves and any other types of organic matter. Local soils to be stabilized shall be granular in nature and approved prior to use. All borrow shall conform to the requirements of Subsection 209.04, Borrow Type E.

304.03 Equipment. The type, condition, and quantity of equipment furnished shall meet the qualifications necessary for the proper execution of the work within the specified working time. Equipment shall bear the manufacturer's name plate, on which shall be stamped the model number. All equipment shall be maintained in good condition and be subject to approval prior to and during its use in connection with the Project. Compaction equipment shall also conform to the requirements of Subsection 202.05 (d).

304.04 Construction Methods. Before any stabilization is started, the roadway shall be widened and graded. Ditches and slopes shall be cut, borrow shall be placed, and the entire section shall be formed in accordance with the typical sections shown on the Plans. Where applicable, the requirements of Section 202 shall apply.

After the prepared roadway has been approved and prior to the addition of asphalt, the base course shall be scarified to the full depth that will give, when mixed with asphalt, a compacted base having a thickness as shown on the Plans and within the specified tolerances. The scarified base course shall then be mixed, and water shall be added or aeration shall take place until the moisture content of the soil to be stabilized is between 90 and 110% of the optimum mixing moisture as determined by the

Department. Mixing shall continue until clay lumps and other cohesive materials present are broken up and distributed evenly. The mixing operation shall be considered complete when the moisture content of the material to be stabilized is uniform and between 90 and 110% of the optimum mixing moisture and the soil lumps have been pulverized.

After the base course has been mixed as described in this Subsection, asphalt shall be applied at a temperature between 140 and 170 EF (60 and 77 EC). The quantity of asphalt shall range from 14 to 20 gal/yd; (70 to 100 L/m;) of compacted thickness of base shown on the Plans, depending on the properties of the soil. The number of gallons per cubic yard (liters per cubic meter) to be applied will be determined by the Department.

No asphalt shall be applied unless the mixing operation can be completed within two and one-half daylight hours following the application of the asphalt. Asphalt shall not be applied to a new section on any succeeding day until those portions which have been mixed previously are aerated and compacted to the specified requirements. If field conditions render the requirements of the preceding sentence impracticable, such as inclement weather, then the Engineer will have the option of waiving the requirements.

Immediately following the application of asphalt, the base course shall be thoroughly mixed with self-propelled mixers. There must be at least two self-propelled mixers of the multiple pass type or one of the single pass type used in this phase of the stabilization operation. During the mixing operation, care shall be taken to avoid cutting below the prepared soil layer and incorporating additional raw soil into the mix. The mixing operation shall be considered complete when the asphalt and soil have been thoroughly mixed to a uniform color free from fat spots, streaks, balls, and uncoated particles throughout the full length, width, and depth of the section.

Following the mixing of the asphalt and soil, a period of aeration shall take place until the moisture content of the mixture is between 75 and 100% of the optimum moisture content as determined by AASHTO T 180 Method A, Modified. Compaction shall then begin, starting at the edges and progressing toward the center of the base course. This compaction shall continue until the base course is shaped and rolled until approved. The thickness of the stabilized base and the surface of the base course will then be tested and shall conform to the tolerances as specified:

- a. *Thickness.* The thickness of the soil asphalt mixture shall be within 2" (13 mm) of the plan thickness and shall be determined from the average of a set of measurements taken through holes made through the finished soil asphalt mixture at intervals not to exceed 500' (150 m) per lane. A set of measurements consists of three holes spaced 5' (1.5 m) apart in a triangular pattern with the thickness measured to the nearest 3" (6 mm). Measurements will be made immediately following the finishing operation.

If the average thickness shown by a set of measurements is not within the tolerances specified, additional sets of measurements shall be made at 25' (7.5 m) intervals forward and backward until at least two consecutive sets of measurements in each direction are within the tolerance specified. Areas represented by averages exceeding the tolerances specified may be required to be reconstructed.

- b. *Surface.* The surface smoothness of the asphalt stabilized base course mixture during and after the compaction and finishing operations shall be tested with a 10' (3.048 m) straightedge furnished by the Contractor. The straightedge shall be laid parallel to the centerline. Any irregularities greater than "2" ("13 mm) shall be satisfactorily corrected.

The base course shall then be opened to traffic, before sealing, for a period of time necessary to cure the stabilized mixture. This curing period shall not be more than 14 days unless otherwise approved. The stabilized base course shall be considered satisfactory for surfacing when the stabilized mixture has attained the following:

- a. a minimum density of 120 lb/ft; (1925 kg/m;) or a minimum of 95% of the maximum dry density as determined by AASHTO T 180 Method A, Modified;
- b. a moisture content that does not exceed 65% of the optimum moisture content as determined by AASHTO T 180 Method A, Modified; and
- c. base course that is properly shaped and has no soft, wet, or unstable areas.

No stabilization shall start on any project or portion thereof before April 1 of each year. All stabilization shall stop by September 30 of each year.

304.05 Method of Measurement. The quantity of asphalt stabilized base course will be measured as the number of miles (kilometers) measured along the centerline of the completed and accepted roadway. Seal material and asphalt for stabilization will be measured according to Subsection 404.16.

304.06 Basis of Payment. The quantity of asphalt stabilized base course will be paid for at the Contract unit price per mile (kilometer). Price and payment will constitute full compensation for all mixing, shaping, removing, and disposing of excess and unsuitable materials and for all labor, equipment, tools, and incidentals required to complete the work. Seal coat material and asphalt for stabilization will be paid for separately.

SECTION 305 GRADED AGGREGATE FOR TEMPORARY ROADWAY MATERIAL (TRM)

305.01 Description. This work consists of furnishing and placing graded aggregate as temporary roadway material (TRM) for the maintenance and repair of the roadway, for pipe and utility crossings, for driveways and entrances, for temporary ramps up to curbs, and for other areas as directed by the Engineer. TRM under this Section shall not be used for constructing detour roads or other temporary roadways; however, it can be used for their maintenance.

305.02 Materials. Graded aggregate for TRM shall conform to the requirements of Section 821, Type B.

305.03 Construction Methods. Repair of the existing pavement and the placement of TRM shall be done as approved or directed by the Engineer. The work shall be coordinated with all other work and operations necessary to maintain traffic.

305.04 Method of Measurement. The quantity of graded aggregate for TRM will be measured as the actual number of tons (metric tons) of graded aggregate placed and accepted. The weight will be determined according to Subsection 109.01.

305.05 Basis of Payment. The quantity of graded aggregate for TRM will be paid for at the Contract unit price per ton (metric ton). Price and payment will constitute full compensation for furnishing, preparing, hauling, placing and compacting all materials; for disposal of temporary roadway material; and for all labor, equipment, tools and incidentals required to complete the work.